LuK Failure Diagnosis

Guidelines for Evaluating Clutch System Malfunctions

LuK INA FAG RUVILLE

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1 Assessing Clutch System Malfunctions

During the course of over 100 years of automotive history, all vehicle components have undergone some pivotal steps in their development. Reliability, ease of maintenance, lower production costs and better environmental compatibility have been, and continue to be, the criteria that demand new and better solutions from automotive engineers. The clutch system has also been undergoing a continuous process of optimization over the years. Current generations of vehicles are equipped with clutch systems that function under normal driving conditions without malfunctioning and with extremely low maintenance requirements over their entire service life.

It is now rare to carry out work on a clutch system. For this reason, clutch systems are no longer considered a part of the daily routine at most garages. Nevertheless, every driver expects professional repair work to be completed when damage to the clutch needs to be rectified. To fulfil these expectations, the first priority must be speaking with the customer. Below, we have provided some important information that can be used during the initial assessment of the damage. In connection with the experience of the garage, malfunctions can generally be grouped into one of the following categories right from the start.

Malfunctions due to wear
Malfunctions that occur after a clutch mileage of 150,000 km can be considered to be normal wear. When this is the case, it can be assumed that the damage can be rectified via a simple diagnosis and superficial labor.

Malfunctions due to increased loading
The earlier a malfunction occurs before a mileage of 150,000 km, the more likely it is that the clutch has been subjected to increased loading. In this case, a highly comprehensive diagnosis is recommended since the causes for this type of malfunction could be much more varied.

HIGH CLUTCH LOADING:

Examples
- Frequently loading boats into and out of water
- Driving in traffic on an incline with a trailer attached
- Racing starts
- Long periods of clutch engagement during hill starts
- Driving with the clutch pedal as a footrest
- Long periods of idling with the clutch engaged
- Frequent journeys with a caravan attached
- Chip tuning

Once it has been ascertained whether the malfunction was caused by normal wear or increased loading, the malfunction can be assigned to one of the five possible causes of complaints.

Possible causes of complaints relating to the clutch:
- Clutch does not disengage
- Clutch slips
- Clutch grabs
- Clutch makes noise
- Clutch control is difficult

This brochure contains detailed information for diagnosing the causes of the complaints listed above, as well as damage patterns with explanations. This information thus provides an important reference for targeted troubleshooting.

Tips for troubleshooting

Once the reason for the complaint has been ascertained, troubleshooting within a specific area can begin. However, a common error is to immediately begin disassembling the clutch, which requires considerable effort in most cases. Technicians often fail to first look for the fault in locations in which it could be remedied by relatively simple means – namely in the area around the clutch.

Before removing the transmission, the area around the clutch must be inspected for possible error sources.

Possible defects in the area around the clutch

Clutch slips:

- Leaks in the engine near the bell housing
- Play of the clutch cable is too low
- Clutch cable is bent
- Fault with the hydraulic release system

Clutch grabs:

- Fault in the engine management system
- Engine mechanism is defective
- Engine/transmission mounting is damaged
- Stiff throttle control
- Dislodged shafts or joints
- Disk joint (flex disk) is worn
- Leaking engine components near the bell housing
- Clutch cable is defective/worn
- Air in the hydraulic release system

Clutch does not disengage:

- Clutch pedal travel is restricted due to several layers of floor mats
- Clutch cable is worn or incorrectly set
- Air in the hydraulic release system
- Hydraulic fluid level is too low

Clutch makes noise:

- Pedal mechanism is worn
- Clutch cable is defective
- Dislodged release shaft/bearing arrangement
- Master/slave cylinder is damaged

Clutch control is difficult:

- Pedal mechanism is worn
- Clutch cable is defective
- Dislodged release shaft/bearing arrangement
- Master/slave cylinder is damaged

Overview of the Most Important Diagnostic Steps

1. UNDERSTANDING THE MALFUNCTION FROM THE CUSTOMERS PERSPECTIVE

Malfunction:

- What is the subject of the complaint?
- Can the malfunction be reproduced by performing a test drive?
- Does the complaint occur only under particular circumstances (e.g. after long periods of inactivity, after driving on the highway, after a cold start)?
- Does the fault only occur after a particular driving manoeuver?
- Was the complaint detected immediately at this intensity, or did it develop over a certain period of time?
- Was a strange odor detected while driving or after stopping the vehicle?

2. DETERMINING THE OPERATING CONDITIONS OF THE VEHICLE

Wear:

- How high is the total mileage of the vehicle?
- Was the total mileage covered with just one clutch kit?
- Is the vehicle subject to extraordinary loading (e.g. used as a taxi or by a driving school, chip tuning, frequent undertakes journeys with trailers or is operated for commercial use)?

Operation:

- Who drives the vehicle: a novice driver or an experienced driver?

Previous repairs:

- Have repairs already been carried out on the clutch and the transmission? If yes: Are there documents about the scope of the work or information about which spare parts (part numbers) were used?

3. USING THE EXPERIENCE OF SPECIALISTS

Are solutions or information already available regarding the malfunction?

- Product catalog/service information: **www.repxpert.com**

4. CLASSIFYING THE COMPLAINT AND CONTINUING THE DIAGNOSIS USING THE RELEVANT INSTRUCTIONS

- Clutch slips
  › Instructions from page 10 ‹
- Clutch grabs
  › Instructions from page 16 ‹
- Clutch does not disengage correctly
  › Instructions from page 23 ‹
- Clutch makes noises
  › Instructions from page 30 ‹
- Clutch control is difficult
  › Instructions from page 37 ‹


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1.1 Diagnosing a Slipping Clutch

HOW DOES THE DAMAGE BECOME APPARENT?
- The engine speed increases when moving off/accelerating. The speed does not increase at all, or only does so slowly
- With the parking brake applied and when attempting to move off in third gear, the engine does not cut out
- The vehicle can no longer be moved by its own force

THE THEORY: WHAT COULD BE DEFECTIVE?
- Clutch disk
- Clutch pressure plate
- Release system
- Friction surface on the flywheel is worn
- Slipping clutch in the DMF is worn

WHAT MUST BE CHECKED BEFORE REMOVING THE CLUTCH?

Actuation:
- Pedal mechanism
- Clutch play
- Clutch cable
- Master/slave cylinder and hoses

WHAT MUST BE DETERMINED AFTER REMOVING THE CLUTCH?

Clutch disk:
- Lining is covered in oil
- Lining is covered in excess grease
- Lining is burned/carbonized
- Lining is worn down to the rivets
- Mechanical damage

Clutch pressure plate:
- Overheating of the pressure plate (blue coloration)
- Heavy scoring on the pressure plate
- Disk spring is broken

Release system:
- Release bearing/guiding sleeve is stiff
- Concentric slave cylinder (CSC) is leaking/stiff
- Guiding sleeve is worn

Flywheel/DMF:
- Scoring/cracks in the friction surface
- Flywheel height dimension is outside of the tolerance range
- Slipping clutch in the DMF is worn (holes obscure the crankshaft screws)

POSSIBLE CAUSES
- Normal wear
- Driving frequently with a slipping clutch
- Rotary shaft seal on the crankshaft or transmission is leaking
- Engine tuning (chip tuning) has destroyed the slipping clutch in the DMF
- Hub of the clutch disk has been over-greased
- Clutch has been operated after reaching the wear limit
- Clutch has been subjected to excessive thermal loading (to the point that an odor is generated)
- Frequent rapid engagement (racing starts)
- Unsuitable hydraulic fluid has been used in the release system
- Burst speed of the clutch disk has been exceeded, causing the lining to detach

Note:
Many DMFs feature a slipping clutch. This mechanism for preventing overloading is designed only for short-term loading peaks during normal driving operations. In the event of continuous overloading, e.g. caused by driving with an impermissibly high trailer load or performance improvements (chip tuning), the slipping clutch will wear prematurely. As a result, the flange is able to transfer less engine torque over time. In extreme cases, the power transmission in the DMF becomes so weak that the transferable engine torque is no longer sufficient to drive the vehicle. This error scenario is often diagnosed as the clutch slipping. However, replacing the clutch does not resolve the complaint in this case.

To avoid misdiagnosis in cases of damage, the DMF must also be inspected during the repair. If the holes in the primary and secondary flywheel are so offset that it is impossible to remove the mounting screws, this can indicate that there is a defective flange on the slipping clutch.

If the holes are offset in relation to the screws, the DMF could already be damaged. If this is the case, an in-depth inspection using the LuK special tool (part no. 400 0080 10) is recommended.

Damage Patterns

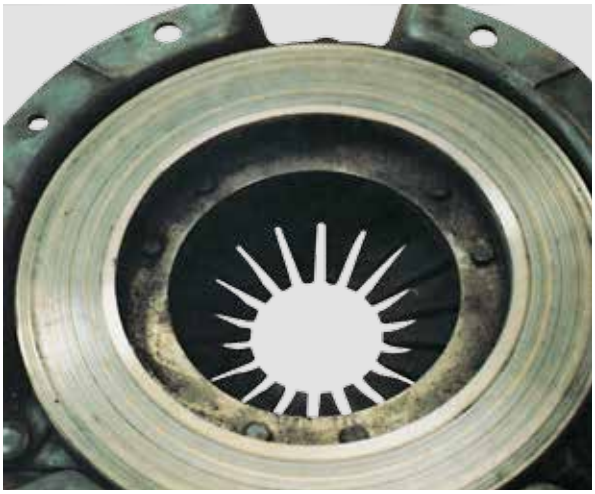
THERMAL LOADING ON THE PRESSURE PLATE IS TOO HIGH

CAUSES:
- Oil or grease on the clutch linings
- Play of the release bearing is too low
- Release system is defective
- Operating error, e.g. allowing the clutch to slip for too long

EFFECTS:
- Clutch slips
- Odor or smoke is generated when driving
- Power transmission malfunctions

SOLUTION:
- Rectify the cause
- Replace the clutch kit
- Advise the driver regarding possible operating errors (see page 6)

HEAVY SCORING AND TRACES OF OVERHEATING ON THE PRESSURE PLATE



CAUSES:
- Clutch has been operated beyond the wear limit
- Play of the release bearing has been set incorrectly
- Release system is defective
- Operating error

EFFECTS:
- Clutch slips
- Odor or smoke is generated when driving
- Power transmission malfunctions

SOLUTION:
- Rectify the cause
- Replace the clutch kit
- Advise the driver regarding possible operating errors (see page 6)

DISK SPRING TIPS HAVE BEEN RUN IN

CAUSES:
- Release bearing preload has been set incorrectly
- Release bearing is stiff
- Hydraulic release system is defective

EFFECTS:
- Clutch slips
- Increased wear on the disk spring tips, to the point that the clutch malfunctions

SOLUTION:
- Check the release system and rectify damage if necessary
- Replace the clutch, release bearing and guiding sleeve

TRACKS IN THE RELEASE BEARING SLEEVE

CAUSES:
- Release bearing has been incorrectly or insufficiently greased, or not greased at all
- Sliding bush is worn
- Release bearing is stiff

EFFECT:
- Clutch slips

SOLUTION:
- Replace the sliding bush and the release bearing
- Grease according to the vehicle manufacturer's specifications if necessary
- Replace the clutch kit

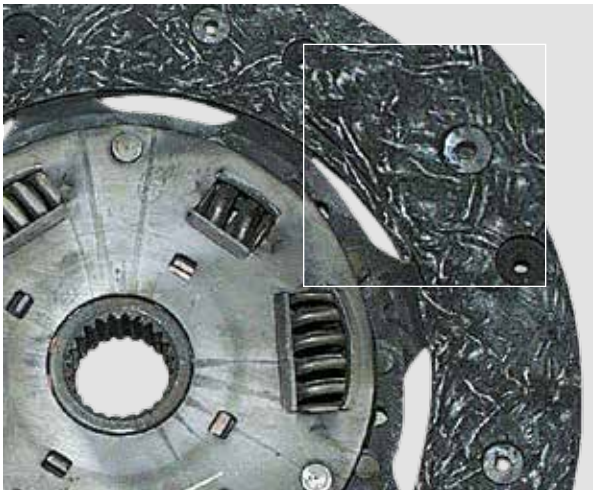
FRICTION LINING ON THE INNER RING IS OILY/ GREASY

CAUSES:
- Radial shaft seals or other components in the engine/transmission are leaking
- Hydraulic release system is defective
- Hub profile over-greased

EFFECTS:
- Lubricant is transferred via the centrifugal force from the hub profile onto the clutch lining, leading to fluctuation of the frictional coefficient, which causes the clutch to grab or slip

SOLUTION:
- Replace the clutch kit
- Follow the greasing guidelines for the hub
- Check the release system
- Check the engine and transmission for leaks

CLUTCH LINING IS CARBONIZED



CAUSES:
- Radial shaft seals or other components in the engine/transmission are leaking
- Hydraulic release system is defective
- Hub profile over-greased
- Decrease in the frictional coefficient due to overheating (e.g. by allowing the clutch to slip for too long)

EFFECTS:
- Clutch slips
- Odor or smoke is generated when driving

SOLUTION:
- Seal the leaks
- Replace the clutch kit (grease the hub profile correctly)
- Advise the driver regarding possible operating errors (see page 6)

CLUTCH LINING IS OILY

CAUSES:
- Radial shaft seals or other components in the engine/transmission are leaking
- Hydraulic release system is defective
- Hub profile over-greased

EFFECTS:
- Clutch slips
- Odor or smoke is generated when driving
- Power transmission malfunctions

SOLUTION:
- Replace the rotary shaft seals
- Clean the clutch cover
- Replace the clutch kit

CLUTCH LININGS ARE COVERED IN EXCESS GREASE

CAUSES:
- Hub of the clutch disk has not been greased correctly
- Too much lubricant has been used

EFFECTS:
- Clutch slips
- Odor or smoke is generated when driving
- Power transmission malfunctions

SOLUTION:
- Clean the clutch cover
- Clean the transmission input shaft
- Replace the clutch kit
- Grease the hub correctly

CLUTCH LINING IS WORN DOWN TO THE RIVETS

CAUSES:
- Normal wear
- Vehicle was still driven despite the clutch slipping
- Driving errors (in the event of a premature malfunction)
- Incorrect clutch
- Release system is defective

EFFECTS:
- Clutch slips
- Odor or smoke is generated when driving
- Power transmission malfunctions

SOLUTION:
- Replace the clutch kit
- Check the release system and repair if necessary
- Advise the driver regarding possible operating errors (see page 6)

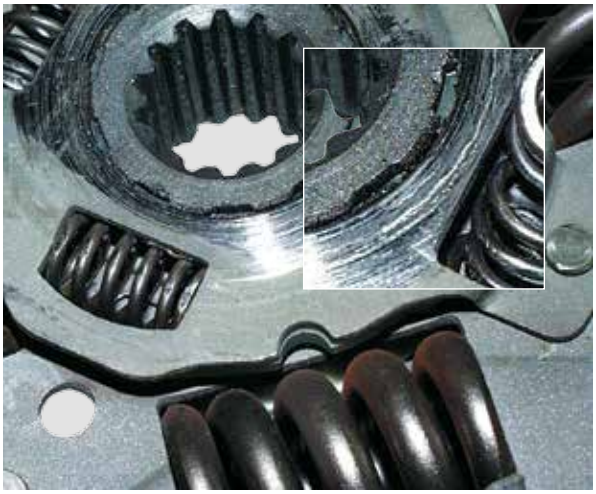
LINING SCORED ON THE FLYWHEEL SIDE

CAUSES:
- Wear on the friction surface of the flywheel was not noticed when the clutch was replaced
- Rigid flywheel has not been reworked or the DMF has not been replaced

EFFECT:
- Clutch grabs with varying intensity

SOLUTION:
- Replace the clutch kit
- Rework the friction surface or replace the flywheel (in the case of a rigid flywheel)
- Do not rework the friction surface of the DMF! If worn, replace the component

CONTACT TRACKS ON THE HUB OF THE CLUTCH DISK



CAUSES:
- Assembly error (installation direction of the clutch disk is incorrect)
- Incorrect clutch disk has been installed

EFFECTS:
- Clutch slips
- Noise

SOLUTION:
- Replace the clutch kit
- Note the correct installation position of the clutch disk

GUIDING SLEEVE IS WORN

CAUSES:
- Normal wear
- Insufficient/unsuitable lubricant has been used
- Material pairing between the guiding sleeve/release bearing is incorrect
- Release bearing is stiff

EFFECTS:
- Clutch slips
- Odor or smoke is generated when driving
- Power transmission malfunctions

SOLUTION:
- Replace the clutch kit
- Replace the guiding sleeve
- Follow the greasing guidelines

PRESSURE PLATE HAS OVERHEATED/BROKEN

CAUSES:
- Damage caused by force and operating errors
- Driving with an excessive load

EFFECTS:
- Clutch slips
- Odor or smoke is generated when driving
- Power transmission malfunctions

SOLUTION:
- Replace the clutch kit
- Advise the driver regarding operating errors

CLUTCH DISK HAS BURST

CAUSES:
- Damage caused by force and operating errors
- Speed of the clutch disk was higher than the burst speed of the lining. This condition occurs when the speed of the vehicle exceeds the maximum permissible speed of the gear when the gear is engaged and the clutch is actuated continuously

Example:
Driving downhill in first gear with the clutch actuated, at a speed of 100 km/h

EFFECTS:
- Power transmission malfunctions
- Odor, noise or smoke is generated when driving

SOLUTION:
- Replace the clutch kit
- Advise the driver regarding operating errors

GEARING MISSING ON THE HUB OF THE CLUTCH DISK

CAUSES:
- DMF is defective
- DMF is blocked because the pressure plate screws are too long
- Vibration damper for the belt pulleys is defective

EFFECT:
- Power transmission malfunctions

SOLUTION:
- Repair the torsional vibration damper
- Check the transmission input shaft
- Replace the clutch kit

1.2 Diagnosing a Grabbing Clutch

HOW DOES THE DAMAGE BECOME APPARENT?

- The engine torque is unevenly transferred when moving off, causing the vehicle to vibrate and noise to be generated from the powertrain, e.g. when moving off on a hill in reverse gear

THE THEORY: WHAT COULD BE DEFECTIVE?

- Clutch disk
- Clutch pressure plate
- Release fork is worn
- Engine suspension/mounting
- Transmission suspension/mounting
- Universal shafts
- Disk joint
- Friction surface on the flywheel/DMF
- Axial clearance of the crankshaft is outside of the tolerance range

WHAT MUST BE CHECKED BEFORE REMOVING THE CLUTCH?

Actuation:

- Pedal mechanism
- Clutch cable
- Release shaft
- Master/slave cylinder and hose

Powertrain/engine:

- Engine management system
- Engine suspension/mounting

Transmission:

- Transmission suspension/mounting

Drive:

- Universal shafts
- Disk joint

WHAT MUST BE DETERMINED AFTER REMOVING THE CLUTCH?

Clutch disk:

- Lining is covered in oil
- Lining is glazed
- Bearing area is not OK
- Impermissible lateral runout of the clutch disk (max. 0.5 mm)

Clutch pressure plate:

- Tangential leaf spring is buckled/broken
- Disk spring fingers are bent
- Cover has shifted, e.g. because it was installed without special tools

Release system:

- Release bearing/release shaft bearing has been run in, release fork has been run in
- Guiding sleeve is corroded
- CSC is leaking/stiff

Flywheel/DMF:

- Friction surface is not OK

Engine:

- Axial clearance of the crankshaft is too high

POSSIBLE CAUSES

- Transmission input shaft has been over-greased
- Unsuitable lubricant has been used
- Assembly error (transmission was installed without using a lifting device and left to hang with the input shaft in the clutch hub)
- No centering sleeve on the engine
- Clutch has been subjected to excessive thermal loading (to the point that an odor is generated)
- Thrust bearing on the crankshaft is defective
- Error when towing the vehicle:
  Going through a car wash with first gear engaged (the tangential leaf spring is buckled by the impact of the reverse torque)

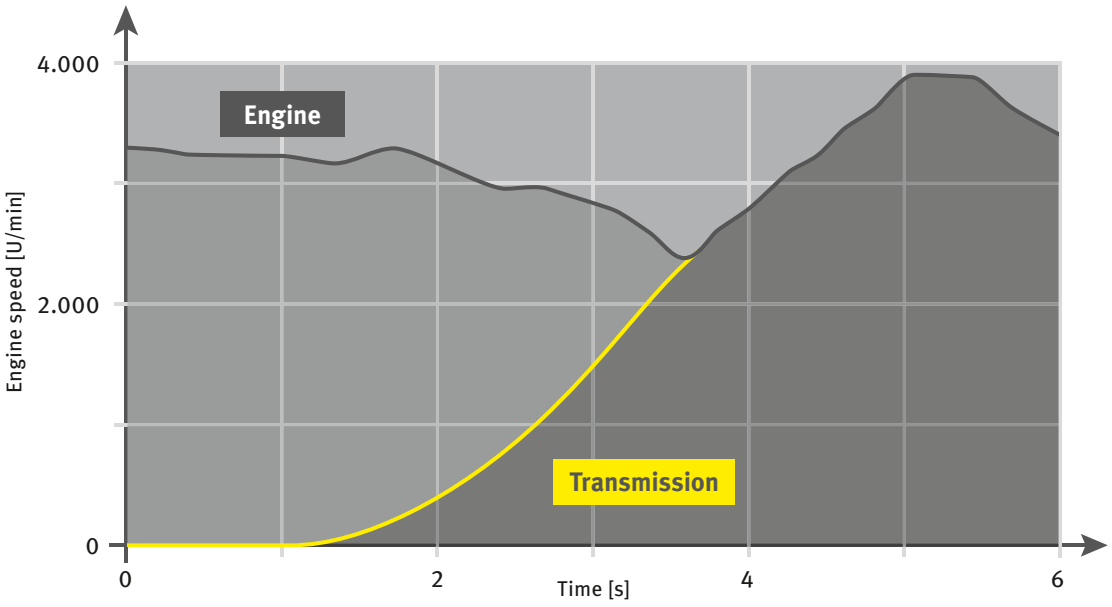
Note:
Malfunctions of the DMF do not cause the clutch to grab. Replacing the DMF does not resolve the complaint in this case!

What happens when the clutch grabs?

The clutch is grabbing when periodic fluctuations in the rpm occur as the torque is transferred to the transmission when the vehicle moves off.

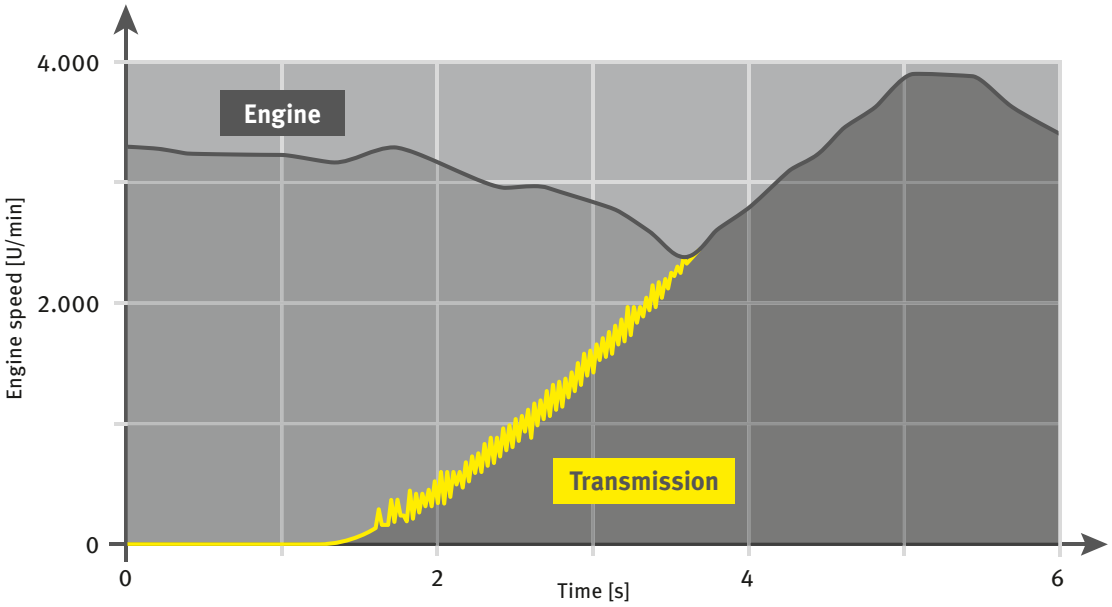
The two graphs show typical start-up procedures. During the engagement process, i.e. during the clutch slip stage, the transmission input speed from a standstill is adjusted to match the engine speed.

Clutch does not grab



A normal start-up procedure, in which the speed of the transmission input shaft (the yellow line) is steadily adjusted to match the speed of the crankshaft.

Clutch grabs



When the clutch grabs during a start-up procedure, vibrations occur in the form of periodic fluctuations in the rpm, which generally last until the two speeds have reached the same level. These deviations are perceived during every start-up procedure as irritating vehicle vibrations.

Damage Patterns

RELEASE FORK TIPS ARE WORN (PULL-TYPE CLUTCH)

CAUSES:
- Normal wear
- Release fork was not replaced when the clutch was replaced despite wear

EFFECTS:
- Release load cannot be evenly transferred to the release bearing
- Clutch grabs

SOLUTION:
- Replace the release fork each time a clutch is replaced

HUB PROFILE HAS BEEN INCORRECTLY GREASED

CAUSE:
- Unsuitable or excessive grease has been applied

EFFECT:
- Lubricant is transferred via the centrifugal force to the friction surfaces of the clutch, leading to fluctuation of the frictional coefficient, which causes the clutch to grab

SOLUTION:
- Observe the specifications of the vehicle manufacturer for greasing the hub when performing a clutch replacement. Use the instructions on page 40 as an alternative if there are no documents available from the vehicle manufacturer

TANGENTIAL LEAF SPRING IS BENT

CAUSES:
- Play within the powertrain (e.g. due to a dislodged disk joint or flex disk)
- Reverse torque transmission in the clutch (towing in first or second gear, shifting error, load reversal caused by the conveyor belt in a car wash when the vehicle is in first gear)

EFFECT:
- Uneven lift of the pressure plate causes the clutch to grab

SOLUTION:
- Replace the clutch kit
- Check the powertrain and eliminate play if necessary
- Advise the driver regarding possible operating errors

DISK SPRING TIPS ARE BENT

CAUSE:
- Assembly error: Disk spring tips have been bent during installation of the transmission

EFFECT:
- Clutch grabs because the release bearing is not positioned uniformly on all disk spring tips

SOLUTION:
- Replace the clutch kit
- Remove and install the transmission in accordance with the vehicle manufacturer's instructions

CLUTCH LINING IS OILY

CAUSES:
- Assembly error (incorrect and/or excessive lubricant applied)
- Engine or transmission is leaking

EFFECT:
- Clutch grabs with varying intensity

SOLUTION:
- Replace the clutch kit
- Eliminate leaks from the engine and transmission
- Note the specifications for greasing the clutch hub

RELEASE BEARING IS STIFF, SIGNS OF WEAR ARE VISIBLE

CAUSES:
- Incorrectly or insufficiently greased
- Sliding bush is worn and was not replaced when the clutch was replaced

EFFECTS:
- Clutch grabs with varying intensity
- Clutch is difficult to modulate

SOLUTION:
- Replace the clutch kit, release bearing and sliding bush
- Note the specifications for greasing the release bearing and the sliding bush

LINING SCORED ON THE FLYWHEEL SIDE

CAUSES:
- Wear on the friction surface of the flywheel was not noticed when the clutch was replaced
- Rigid flywheel has not been reworked or the DMF has not been replaced

EFFECT:
- Clutch grabs with varying intensity

SOLUTION:
- Replace the clutch kit
- Rework the friction surface or replace the flywheel (in the case of a rigid flywheel)
- Do not rework the friction surface of the DMF! If worn, replace the component

RELEASE BEARING HAS BEEN INCORRECTLY GREASED

CAUSE:
- Release bearing or sliding bush have been greased using an unsuitable lubricant

EFFECT:
- Along with wear debris, unsuitable lubricant causes the release bearing to stick to the sliding bush. The clutch grabs because it cannot engaged smoothly

SOLUTION:
- Replace the clutch kit
- Clean the sliding bush and release bearing and replace if necessary
- Follow the greasing guidelines

GUIDING SLEEVE HAS BEEN RUN IN

CAUSES:
- Normal wear
- Sliding bush is worn and was not replaced when the clutch was replaced

EFFECT:
- Uneven running surface on the sliding bush causes the release bearing to stick to the sliding bush and the clutch to grab

SOLUTION:
- Replace the guiding sleeve
- Replace the clutch kit
- Follow the greasing guidelines

OFF-CENTER CONTACT TRACK IN THE RELEASE SPRING (VW CLUTCH SYSTEM)

CAUSES:
- Release bearing on the push rod is deformed
- Guide bush on the push rod is worn

EFFECT:
- Uneven lift of the pressure plate causes the clutch to grab

SOLUTION:
- Replace the clutch kit
- Check the release bearing of the push rod and replace if necessary
- Check the guide bush of the push rod and replace if necessary

FRICTION SURFACE ON THE FLYWHEEL IS WORN

CAUSES:
- High temperatures, e.g. due to operating errors or a defect in the release system
- Friction surface on the flywheel is worn (rigid design) and was not reworked when the clutch was replaced
- DMF is worn and has not been replaced

EFFECT:
- Insufficient frictional coefficient causes the clutch to grab or slip

SOLUTION:
- Replace the clutch kit
- Rework the friction surface or replace the flywheel (in the case of a rigid flywheel)
- Do not rework the friction surface of the DMF! If worn, replace the component

RELEASE FORK AND/OR BALL PIN IS WORN

CAUSE:
- Normal wear

EFFECT:
- Release fork moves unevenly over the ball pin, causing the clutch to grab

SOLUTION:
- Replace the ball pin
- Replace the release fork
- Replace the clutch kit

HUB PROFILE IS DAMAGED

CAUSES:
- Transmission input shaft has been forced into the hub
- Clutch disk was not centered during installation
- Incorrect clutch has been installed

EFFECTS:
- Clutch disk sticks on the transmission input shaft, meaning that the clutch does not disengage completely
- Clutch grabs

SOLUTION:
- Replace the clutch kit
- Center the clutch disk during installation, e.g. using the LuK special tool (part no. 400 0237 10)
- Install the transmission using a suitable lifting device

RELEASE FORK MOUNT ON THE RELEASE BEARING IS BROKEN

CAUSES:
- Fork and release bearing not installed correctly
- Incorrect release bearing installed

EFFECT:
- Uneven power transmission to the release bearing causes the clutch to grab

SOLUTION:
- Replace the clutch kit
- Correctly install the release fork and release bearing

FRICTION LINING ON THE INNER RING IS OILY/ GREASY

CAUSES:
- Radial shaft seals or other components in the engine/transmission are leaking
- Hydraulic release system is defective
- Hub profile over-greased

EFFECT:
- Lubricant is transferred via the centrifugal force from the hub profile onto the clutch lining, leading to fluctuation of the frictional coefficient, which causes the clutch to grab or slip

SOLUTION:
- Replace the clutch kit
- Note the specifications for greasing the hub
- Check the release system
- Check the engine and transmission for leaks

1.3 Diagnosing a Clutch That Will Not Disengage

HOW DOES THE DAMAGE BECOME APPARENT?
- Despite the clutch being actuated, the vehicle continues to move and cracking noises are generated during gear shifting

THE THEORY: WHAT COULD BE DEFECTIVE?
- Clutch pressure plate
- Clutch disk
- Release system
- Clutch control

WHAT MUST BE CHECKED BEFORE REMOVING THE CLUTCH?

Quick test:
- Actuate the clutch, start the engine and shift through all of the gears. Is transmission noise generated when shifting gears?

Actuation:
- Pedal mechanism
- Clutch play
- Clutch cable
- Release fork, release shaft
- Travel of the master/slave cylinder
- Hoses for master/slave cylinder
- Fluid level of the clutch hydraulics
- Ventilation status of the clutch hydraulics

WHAT MUST BE DETERMINED AFTER REMOVING THE CLUTCH?

Clutch disk:
- Hub profile is rusty
- Lining on the mating component is seized with rust
- Lining is broken/loose
- Clutch disk is deformed
- Clutch disk is broken
- Clutch disk has been installed the wrong way around
- Lateral runout of the clutch disk
- Torsion damper spring is broken

Clutch pressure plate:
- Pressure plate is broken
- Tangential leaf spring is buckled
- Tangential leaf spring is broken
- Disk spring fingers have been severely run in
- Cover has bent, e.g. because it was installed without self-adjusting clutch (SAC) special tools

Release system:
- Release bearing or CSC is stiff
- Release shaft bearing is stuck
- Release fork is broken
- Guiding sleeve is corroded

Special cases:
- Transmission input shaft is jammed in the pilot bearing, causing the torque to be transferred when the clutch is disengaged

Multiple disk clutches:
- Valve is not at the flywheel stop (the installation instructions from the vehicle manufacturer have not been followed)

Coil spring clutch:
- Cam or bracket is broken

Pull-type multiple disk clutch:
- Spacers are misaligned

POSSIBLE CAUSES
- Angular displacement between the engine and the transmission
- Clutch disk has been "dished" due to an assembly error
- No centering sleeve on the engine
- Tangential leaf spring is bent/broken due to reverse torque transmission in the clutch (towing in first or second gear, shifting error, load reversal caused by the conveyor belt in a car wash when the vehicle is in first gear)
- Speed of the clutch disk was higher than the burst speed of the lining. This condition occurs when the speed of the vehicle exceeds the maximum permissible speed of the gear when the gear is engaged and the clutch is actuated continuously

If the centering sleeve is missing or deformed, this can cause problems when disengaging the clutch.

Damage Patterns

PILOT BEARING IS DEFECTIVE

CAUSE:
- Pilot bearing was not checked, lubricated or replaced when the clutch was last replaced

EFFECTS:
- Transmission input shaft does not come to a standstill despite the clutch being actuated (drag torque)
- Gears engage only with great effort or with a scratching noise
- Transmission is damaged (synchronizer, input shaft)

SOLUTION:
- Replace the pilot bearing each time a clutch is replaced
- Check the transmission input shaft and replace if necessary

MECHANICAL DAMAGE TO THE CSC

CAUSE:
- Sliding bush of the CSC has rotated and worked loose from the housing due to the axial clearance of the transmission input shaft being too high

EFFECTS:
- CSC is leaking
- Clutch does not disengage
- Clutch is contaminated with brake fluid

SOLUTION:
- Replace the clutch kit
- Check the axial clearance of the transmission input shaft (note the manufacturer's instructions)
- Replace the CSC

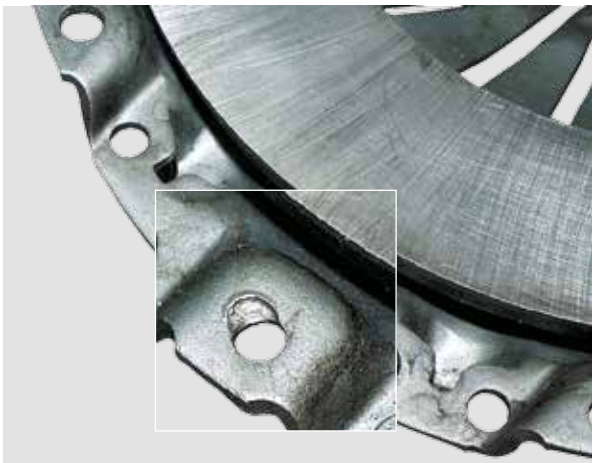
CSC BURSTS DIRECTLY AFTER INSTALLATION

CAUSE:
- When the new CSC was installed, the old seal was not removed from the cable connection. After the installation, the old seal acts as a valve and prevents pressure from being released from the CSC. Once the clutch has been actuated a few times, the pressure increases so much that the CSC bursts

EFFECTS:
- Clutch control is difficult for a short period
- CSC is leaking
- Clutch does not disengage
- Clutch may have been contaminated with brake fluid

SOLUTION:
- Check the seal on the hydraulic line and eliminate foreign bodies/gasket residue
- Replace the CSC

CLUTCH COVER IS DEFORMED



CAUSE:
- Centering pin in the flywheel was not accounted for when installing the pressure plate

EFFECTS:
- Pressure plate is deformed
- Clutch does not disengage
- Noise is generated from the bell housing (pressure plate comes into contact with the housing)

SOLUTION:
- Replace the clutch kit
- Account for the centering pin when installing the pressure plate

THREAD IN THE SCREW HOLES IS WORN, TANGENTIAL LEAF SPRING IS BROKEN (VW)

CAUSES:
- No securing agent used to fix the clutch screws in place
- Reinforcing panel not installed between the clutch screws and the clutch cover
- Screws have been tightened to the incorrect torque

EFFECTS:
- Noise from the bell housing
- Clutch does not disengage

SOLUTION:
- Replace the clutch kit

CONTACT TRACKS ON THE RIVET HEADS OF THE SEGMENT RIVETING (VW)

CAUSES:
- Snap ring on the pressure plate has been installed incorrectly
- Unsuitable snap ring has been installed

EFFECTS:
- Mechanical damage to the clutch disc
- Clutch does not disengage correctly

SOLUTION:
- Replace the clutch kit

TANGENTIAL LEAF SPRING IS BROKEN

CAUSES:
- Play within the powertrain, e.g. a dislodged flex disk
- Operating errors, e.g. towing in first or second gear, shifting error
- Incorrect clutch has been installed

EFFECT:
- Clutch does not disengage

SOLUTION:
- Replace the clutch kit
- Advise the customer regarding possible operating errors

TANGENTIAL LEAF SPRING IS BENT

CAUSES:
- Play within the powertrain, e.g. a dislodged flex disk
- Operating errors, e.g. towing in first or second gear, shifting error
- Improper bearing arrangement for the clutch
- Clutch dropped before or during assembly
- Incorrect detent when screwing on the clutch

EFFECT:
- Clutch does not disengage correctly

SOLUTION:
- Replace the clutch kit
- Advise the customer regarding possible operating errors
- Check for play in the powertrain and eliminate if necessary

LINING IS BURNT OR HAS WORKED LOOSE

CAUSES:
- Defective rotary shaft seal on the engine/gearbox, causing the lining to become oily
- Release system is stiff or defective
- Depth dimension was not considered when reworking the flywheel (rigid design) or the mounting surface of the clutch has not been machined

EFFECT:
- Clutch does not disengage correctly

SOLUTION:
- Eliminate leaks
- Check the release system and repair if necessary
- Replace the flywheel/DMF
- Replace the clutch kit

HUB PROFILE IS DAMAGED

CAUSES:
- Transmission input shaft has been forced into the hub
- Clutch disk was not centered during installation
- Incorrect clutch has been installed

EFFECTS:
- Clutch disk sticks on the transmission input shaft, meaning that the clutch does not disengage completely
- Clutch grabs

SOLUTION:
- Replace the clutch kit
- Center the clutch disk during installation, e.g. using the LuK special tool (part no. 400 0237 10)
- Install the transmission using a suitable lifting device

FRETTING CORROSION (RUST FILM) ON THE HUB PROFILE

CAUSE:
- Transmission input shaft or hub profile not greased at all or greased using an unsuitable lubricant

EFFECT:
- Clutch disk sticks on the transmission input shaft, meaning that the clutch does not disengage completely

SOLUTION:
- Replace the clutch kit
- Follow the greasing guidelines: Take the vehicle manufacturer's specifications into account as a priority when choosing the lubricant. In the absence of any specification, an age-resistant, high-performance grease with MoS2 (e.g. Castrol Olista Longtime 2 or 3) can be used

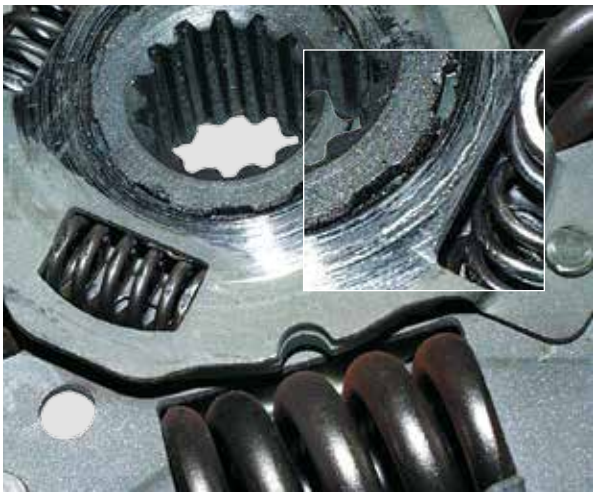
HUB PROFILE IS DEFORMED, TAPERED GEARING PROFILE

CAUSES:
- Pilot bearing is defective
- Angular displacement between the engine and the transmission
- No centering sleeve or the centering sleeve is damaged

EFFECT:
- Clutch disk sticks on the transmission input shaft, meaning that the clutch does not disengage completely

SOLUTION:
- Replace the clutch kit
- Replace the pilot bearing
- Check the fitting sleeves on the engine for damage and replace if necessary

CONTACT TRACKS ON THE FIRST STAGE DAMPER OF THE CLUTCH DISK



CAUSES:
- Installation position for the clutch disk is incorrect
- Incorrect clutch disk has been installed

EFFECT:
- Clutch disk is always in contact with rotating parts of the clutch, meaning that it cannot be fully disengaged from the power flow

SOLUTION:
- Replace the clutch
- Note the correct installation position of the clutch disk: Information regarding the installation direction can generally be found on the hub, e.g. on the flywheel side, engine side, transmission side

CLUTCH DISK HAS BECOME SAUCER-SHAPED

CAUSE:
- Clutch disk has not been centered and has been deformed by subsequent installation of the transmission

EFFECT:
- The lift of the pressure plate is not sufficient to fully disengage the clutch

SOLUTION:
- Replace the clutch kit
- Always center the clutch disk using a suitable tool, e.g. the LuK special tool (part no. 400 0237 10)

DISC ASSEMBLY IS BROKEN

CAUSES:
- Pilot bearing is defective or missing
- Angular or parallel displacement between the engine and transmission
- Transmission has been lowered during installation

EFFECTS:
- Broken-off parts get stuck in the clutch and cause problems when disengaging
- Power transmission malfunctions

SOLUTION:
- Replace the clutch kit
- Check the pilot bearing and replace if necessary
- Always install the gearbox using a suitable lifting device
- Check the centering sleeve and replace if necessary

CONTACT BUSHING AND BALL BEARING ON THE RELEASE BEARING ARE DESTROYED

CAUSE:
- Play of the release bearing has been set incorrectly, causing overheating, loss of lubricant and the bearing being blocked

EFFECT:
- Travel of the release lever is offset in the release bearing, meaning that the clutch can no longer be fully disengaged

SOLUTION:
- Replace the clutch kit
- Replace the release bearing and the guiding sleeve
- Set the play of the release bearing in accordance with the specifications from the vehicle manufacturer

HOUSING OF THE RELEASE BEARING IS DEFORMED

CAUSES:
- Release bearing is blocked on the guiding sleeve
- Bearing arrangement on the release shaft is worn

EFFECT:
- Actuation force just deforms the immovable release bearing, meaning that the clutch cannot be fully disengaged

SOLUTION:
- Replace the clutch kit
- Replace the release bearing and the guiding sleeve
- Check the bearing arrangement of the release shaft and repair if necessary

FLANGE ON THE RELEASE BEARING IS WORN THROUGH

CAUSES:
- Default setting of the release fork is incorrect (Opel)
- Preload on the release bearing is too low

EFFECTS:
- The fact that the bearing preload is missing causes damage to the release bearing during operation
- Clutch does not fully disengage

SOLUTION:
- Set the preload of the release bearing (specification: 80–100 N)
- Replace the release bearing and the guiding sleeve
- Replace the clutch kit

1.4 Diagnosing Clutch Noise

HOW DOES THE DAMAGE BECOME APPARENT?
- Noise when actuating the clutch, when the engine is switched off, when idling or when driving

THE THEORY: WHAT COULD BE DEFECTIVE?
- Clutch control
- Clutch disk
- Clutch pressure plate
- Release system

WHAT MUST BE CHECKED BEFORE REMOVING THE CLUTCH?
Actuation:
- Pedal mechanism
- Clutch cable
- Release shaft
- Master/slave cylinder
- Hoses

WHAT MUST BE DETERMINED AFTER REMOVING THE CLUTCH?
Clutch disk:
- Contact tracks on the hub
- Contact tracks on the torsional damper
- Contact tracks on the cover plate of the torsional damper
- Torsion springs are broken
- Hub profile is deformed

Clutch pressure plate:
- Disk spring fingers have been run in
- Grinding marks on the inside of the disk spring

Release system:
- Bearings on the release bearing/CSC are defective
- Release shaft bearing is defective
- Guiding sleeve has been run in or is corroded

Clutch control:
- Lack of lubricant on moving components

Pilot bearing:
- Lack of lubricant/wear

Flywheel/DMF:
- Blocked/worn

Coil spring clutch:
- Cam or bracket is broken

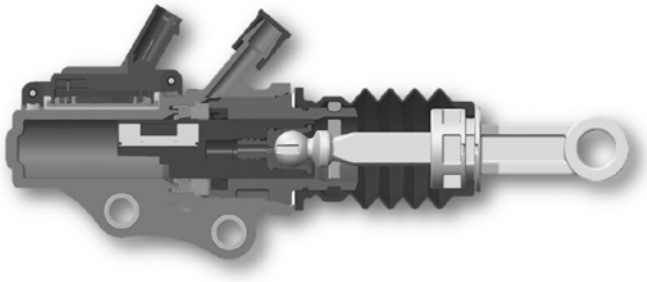
POSSIBLE CAUSES
- Unsuitable or too little lubricant used
- Normal wear
- Assembly error
- The DMF has been blocked because the mounting screws in the pressure plate are too long, causing damage to the hub profile
- Incorrect parts have been fitted

What must be done if the clutch pedal is squeaking?
In the case of a clutch that is actuated purely mechanically, a high-performance lubricant in the right places can effectively eliminate noise. However, any existing wear must be taken into account. Using the correct volume and type of lubricant is also important, especially when it comes to the clutch area.

In the case of modern, primarily hydraulically actuated clutches, no lubricant may be used in the areas around the master and slave cylinders. If noise occurs is these areas, the relevant cylinder must be replaced. Any attempt to remedy the complaint using an arbitrary lubricant or silicone spray will lead to a malfunction in the release system within a very short time frame.

One of the main causes of squeaking noise is the speed-dependent frictional coefficient between the elastomer seals and the seal track. Effective corrective measures such as coatings or special greases have now been developed to deal with this problem. The LuK preference is to use pistons made from duroplastic material in connection with an optimized grease. This means that irritating squeaking noises can reliably be prevented, even under critical climatic conditions and using different types of brake fluid.

Master cylinders in modern vehicles are designed such that they can work without generating noise under critical conditions.



Damage Patterns

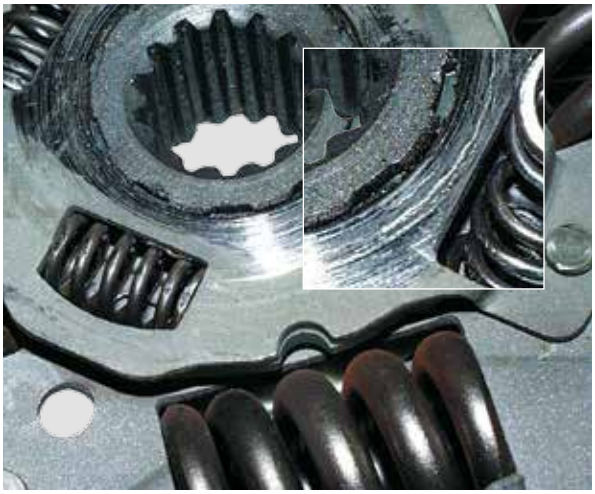
DISK SPRING TIPS HAVE BEEN RUN IN

CAUSES:
- Default setting of the release fork is incorrect (Opel)
- Preload on the release bearing is too low

EFFECTS:
- Due to the lack of bearing preload, the thrust ring slips over the tips of the disk spring and generates noise
- Increased wear on the disk spring

SOLUTION:
- Set the preload of the release bearing (specification: 80–100 N)
- Replace the release bearing and the guiding sleeve
- Replace the clutch kit

CONTACT TRACKS ON THE FIRST STAGE DAMPER



CAUSES:
- Default setting of the release fork is incorrect (Opel)
- Preload on the release bearing is too high

EFFECTS:
- The increased preload causes overpressure on the clutch during operation, which, in turn, causes damage
- Noise is generated when the engine is running and the clutch is actuated

SOLUTION:
- Set the preload of the release bearing (specification: 80–100 N)
- Replace the release bearing and the guiding sleeve
- Replace the clutch kit

CONTACT TRACKS ON THE FORMED SPRING

CAUSES:
- Default setting of the release fork is incorrect (Opel)
- Preload on the release bearing is too high

EFFECTS:
- The increased preload causes the formed spring to come into contact with the rotating disk spring
- Noise is generated when the engine is running and the clutch is actuated

SOLUTION:
- Set the preload of the release bearing (specification: 80–100 N)
- Replace the release bearing and the guiding sleeve
- Replace the clutch kit

SPRING WINDOW IS WORN

CAUSES:
- Driving error: The torsional damper is overloaded as a result of driving at a low engine speed
- Engine operation is irregular
- Fault in the engine management system
- Incorrect clutch disk

EFFECTS:
- Material abrasion on the spring window, causing increased play in the torsional damper
- Noise is generated when the engine is running

SOLUTION:
- Avoid frequently driving at low speeds
- Replace the clutch kit
- Check the engine and engine management system and repair if necessary

TORSION SPRING IS BROKEN

CAUSES:
- Linings are oily
- Incorrect engine setting
- Release system is defective

EFFECTS:
- The causes listed above lead to juddering vibrations, which damage the torsional damper
- Noise is generated when the engine is running

SOLUTION:
- Eliminate leaks
- Check the engine setting
- Replace the release bearing with the guiding sleeve
- Replace the clutch kit

STOP PIN IN THE TORSIONAL DAMPER IS WORN

CAUSES:
- Driving error: The torsional damper is overloaded as a result of driving at a low engine speed
- Engine operation is irregular
- Fault in the engine management system
- Incorrect clutch disk

EFFECTS:
- Material abrasion on the stop pin
- Noise is generated when the engine is running

SOLUTION:
- Avoid frequently driving at low speeds
- Replace the clutch kit
- Check the engine and engine management system and repair if necessary

HUB PROFILE IS DEFORMED, TAPERED GEARING PROFILE TORSIONAL DAMPER IS DESTROYED

CAUSES:
- Pilot bearing is defective
- Angular displacement between the engine and the transmission
- No centering sleeve or the centering sleeve is damaged

EFFECTS:
- Overloading the link between the transmission input shaft and the hub of the clutch disk causes material abrasion
- Noise is generated when the engine is running

SOLUTION:
- Check the centering sleeve and replace if necessary
- Replace the pilot bearing
- Replace the clutch kit

HUB PROFILE IS COMPLETELY MISSING

CAUSES:
- Pilot bearing is missing or defective
- Parallel or angular displacement between the engine and transmission
- Bearing arrangement for the transmission input shaft is defective
- Vibration damage (DMF is defective or blocked)

EFFECT:
- The causes listed above lead to noise in the start-up phase and to a malfunction with the power transmission after a longer period of operation

SOLUTION:
- Replace the pilot bearing or the entire clutch kit
- Check the centering sleeve and replace if necessary
- Check the bearing arrangement of the transmission input shaft and repair if necessary
- Check/replace the DMF

CONTACT BUSHING AND BALL BEARING ARE DESTROYED

CAUSE:
- Release bearing is overheating because the play of the release bearing is incorrect

EFFECT:
- Noise due to the loss of lubricant and eventual blockage of the bearing

SOLUTION:
- Replace the clutch kit
- Replace the release bearing and the guiding sleeve
- Set the play of the release bearing correctly

FLANGE ON THE RELEASE BEARING IS WORN THROUGH

CAUSES:
- Default setting of the release fork is incorrect (Opel)
- Preload on the release bearing is too low

EFFECTS:
- The fact that the bearing preload is missing causes damage to the release bearing during operation
- Noise is generated when the engine is running and the clutch is actuated

SOLUTION:
- Set the preload of the release bearing (specification: 80–100 N)
- Replace the release bearing and the guiding sleeve
- Replace the clutch kit

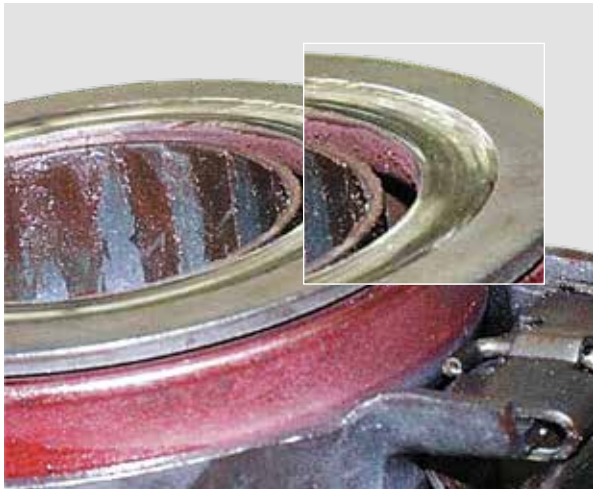
SIGNS OF WEAR VISIBLE ON THE GUIDING SLEEVE

CAUSES:
- Unsuitable or no lubricant used
- Material pairing between the sleeve/bearing is incorrect

EFFECT:
- Friction between the release bearing and the guiding sleeve causes noise when the clutch is actuated

SOLUTION:
- Replace the release bearing and the guiding sleeve
- Follow the greasing guidelines
- Replace the clutch kit

SIGNS OF WEAR VISIBLE ON THE THRUST RING OF THE RELEASE BEARING



CAUSES:
- Default setting of the release fork is incorrect (Opel)
- Preload on the release bearing is too low

EFFECT:
- Friction between the thrust ring and the disk spring causes noise when the engine is running

SOLUTION:
- Set the preload of the release bearing (specification: 80–100 N)
- Replace the release bearing and the guiding sleeve
- Replace the clutch kit

RELEASE BEARING SEATING ON THE RELEASE FORK HAS BEEN RUN IN

CAUSES:
- Normal wear
- Release fork was not replaced when the clutch was replaced
- Lack of lubricant

EFFECT:
- Friction causes noises when the clutch is actuated

SOLUTION:
- Replace the release fork
- Replace the release bearing and the guiding sleeve
- Follow the greasing guidelines
- Replace the clutch kit if necessary

RELEASE BEARING SEATING IS WORN

CAUSES:
- Normal wear
- Release fork was not replaced when the clutch was replaced
- Lack of lubricant

EFFECT:
- Friction causes noises when the clutch is actuated

SOLUTION:
- Replace the release fork
- Replace the release bearing and the guiding sleeve
- Follow the greasing guidelines
- Replace the clutch kit if necessary

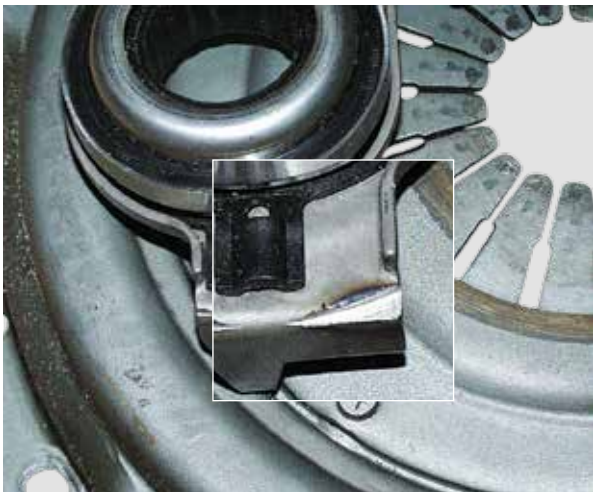
OFF-CENTER CONTACT TRACK IN THE RELEASE SPRING (VW CLUTCH SYSTEM)

CAUSES:
- Release bearing on the push rod is deformed
- Guide bush on the push rod is worn

EFFECT:
- Noise from the bearing arrangement for the push rods when the engine is stationary and when the clutch is actuated

SOLUTION:
- Replace the clutch kit
- Check the release bearing of the push rod and replace if necessary
- Check the guide bush of the push rod and replace if necessary
- Check the push rod and replace if necessary

CONTACT TRACKS ON THE CLUTCH COVER AND RELEASE BEARING



CAUSES:
- Release bearing has been installed incorrectly, causing overpressure in the clutch
- Incorrect parts have been installed

EFFECTS:
- Release bearing comes into contact with the clutch cover
- Noise during driving operations when the clutch is actuated

SOLUTION:
- Replace the clutch kit
- Replace the release bearing

TORSIONAL DAMPER IS BROKEN

CAUSE:
- Driving error: Torsional damper has been destroyed as a result of driving at a low engine speed

EFFECTS:
- Noise during driving operations
- Power transmission malfunctions

SOLUTION:
- Replace the clutch kit
- Replace the release bearing
- Advise the customer regarding possible operating errors

HUB OF THE CLUTCH DISK IS BROKEN

CAUSES:
- Assembly error
- Installation position of the clutch disk has not been taken into account

EFFECTS:
- Noise during driving operations
- Power transmission malfunctions

SOLUTION:
- Replace the clutch kit
- Replace the release bearing
- Note the correct installation position of the clutch disk: Information regarding the installation direction can generally be found on the hub, e.g. on the flywheel side, engine side, transmission side

1.5 Diagnosing a Stiff Clutch

HOW DOES THE DAMAGE BECOME APPARENT?

- Clutch pedal can be operated only using increased force

THE THEORY: WHAT COULD BE DEFECTIVE?

- Clutch pressure plate
- Clutch control
- Release system

WHAT MUST BE CHECKED BEFORE REMOVING THE CLUTCH?

Actuation:

- Pedal mechanism
- Clutch cable
- Release shaft
- Master/slave cylinder
- Hoses

WHAT MUST BE DETERMINED AFTER REMOVING THE CLUTCH?

Release system:

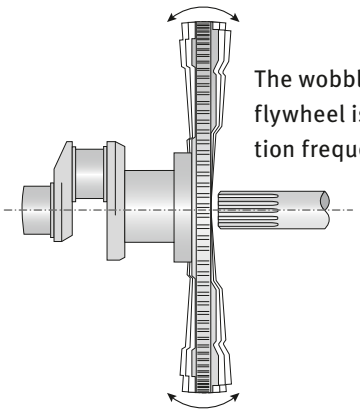
- Release bearing is deformed
- Guiding sleeve has been run in, is corroded and damaged
- Release shaft is deformed/stiff
- Release shaft bearing is deformed
- CSC is defective

POSSIBLE CAUSES

- Unsuitable or too little lubricant used
- Normal wear
- Assembly error

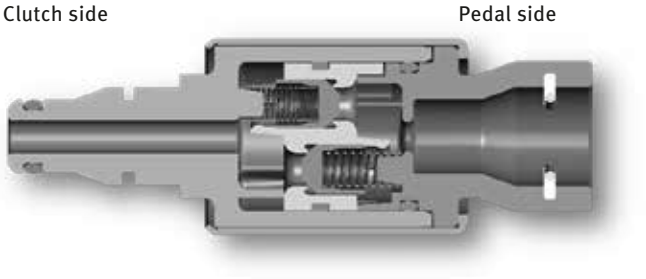
Why does the clutch pedal pulsate when actuated?

The crankshaft is subjected to bending forces as a result of the ignition cycle in the engine. The bending forces also extend along the rotational axis, pulsating in line with the ignition frequency, leading to axial vibration on the flange of the crankshaft, which causes the flywheel to wobble. This movement is transferred from the clutch to the release system, is strengthened by the hydraulic transmission and transferred to the pedal via the fluid. The higher the combustion pressure, the stronger the axial excitation. For this reason, this phenomenon mainly occurs in highly efficient diesel engines.

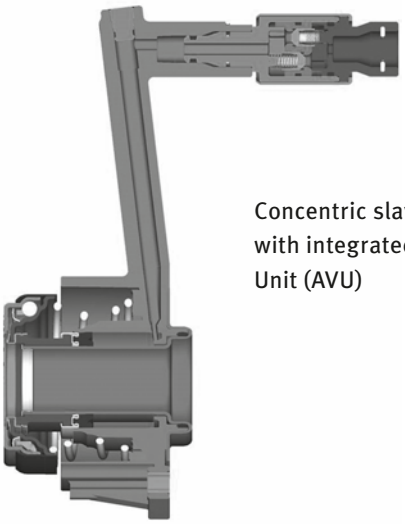


The wobbling movement of the flywheel is caused by the ignition frequency

To reduce the transmission of vibration, hydraulic release systems are fitted with a filter element known as the "AVU" (Anti Vibration Unit). This component is either integrated into the CSC or incorporated into the hydraulic line. If the clutch pedal is clearly pulsating, the malfunction may be caused by this filter element. As it is impossible to check this problem using garage equipment, it is advisable to replace the component.



Function of an AVU



Concentric slave cylinder (CSC) with integrated Anti Vibration Unit (AVU)

Damage Patterns

CONTACT TRACKS ON THE GUIDING SLEEVE

CAUSES:
- Normal wear
- Unsuitable or no lubricant used

EFFECTS:
- Clutch control is difficult
- Noise when actuating the clutch

SOLUTION:
- Replace the clutch kit if necessary
- Replace the release bearing
- Replace the guiding sleeve
- Follow the greasing guidelines

CSC BURSTS DIRECTLY AFTER INSTALLATION

CAUSES:
- The old seal was not removed from the cable joint when a new CSC was installed. After the installation, the old seal acts as a valve and prevents pressure from being released from the CSC. Once the clutch has been actuated a few times, the pressure increases so much that the CSC bursts

EFFECTS:
- Clutch control is difficult
- CSC is leaking
- Clutch does not disengage
- Clutch may have been contaminated with brake fluid

SOLUTION:
- Check the seal on the hydraulic line and eliminate foreign bodies/gasket residue
- Replace the CSC

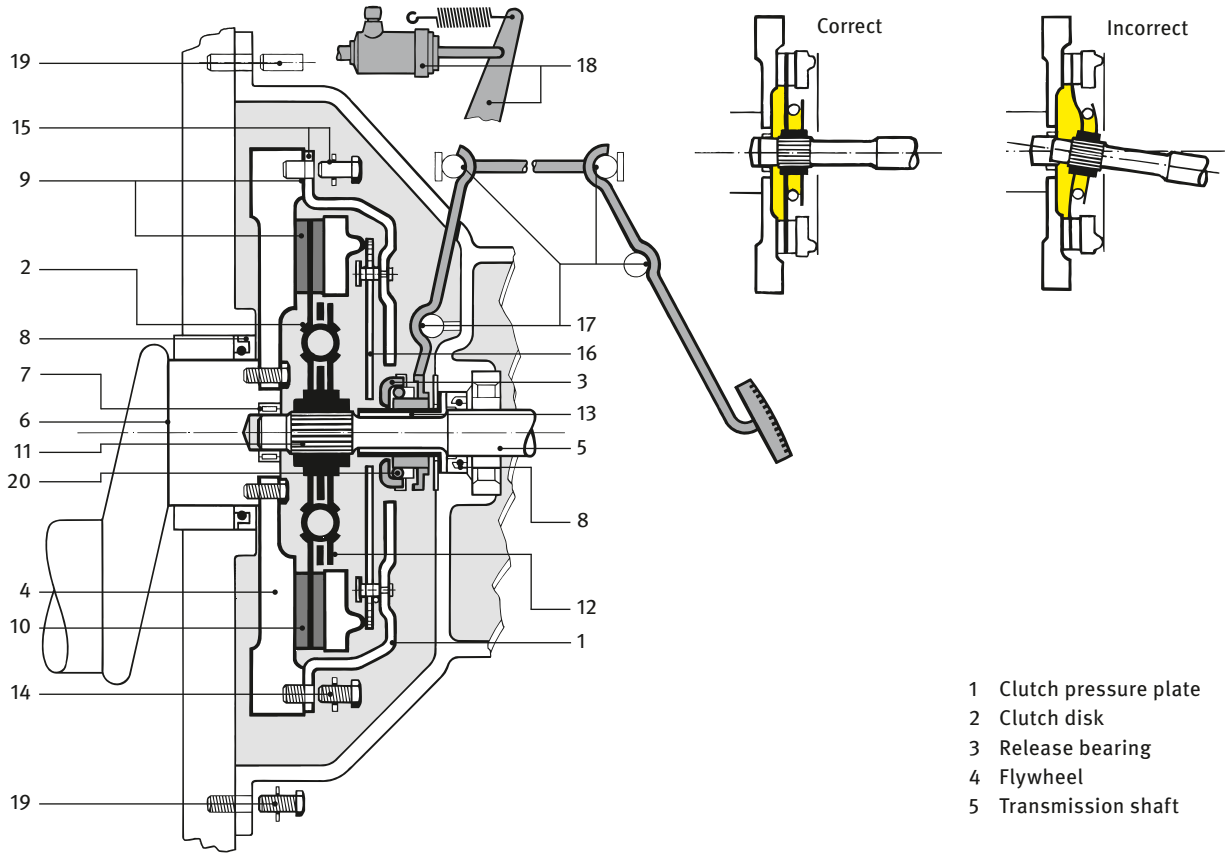
NEW SAC IS ALREADY COMPLETELY ADJUSTED

CAUSES:
- Improper transport
- Assembly error (the detent was removed from the clutch before assembly)

EFFECTS:
- Clutch control is difficult
- Clutch does not disengage

SOLUTION:
- Install a new clutch with a suitable centering sleeve without counterforce, e.g. using the LuK special tool (part no.: 400 0237 10)

2 Tips for Replacing a Clutch Effectively and Efficiently



1 Clutch pressure plate
2 Clutch disk
3 Release bearing
4 Flywheel
5 Transmission shaft

MAKE SURE TO:

- Check the axial clearance of the crankshaft (6) and compare it to the manufacturer's instructions
- Check the pilot bearing (7) and replace it if necessary
- Check the rotary shaft seals (8) on both the engine and the transmission side for leaks and replace the seals if necessary
- Rigid flywheel (9): Check the friction surface for scoring and cracks. If the friction surface is reworked, note the specified tolerances! **Important:** Rework the mounting surface for the clutch to the same extent as the friction surface being machined
- Each time that the clutch is replaced, also replace the DMF using the LuK inspection tool (part no. 400 0080 10). Do not rework (complete truing work on) the friction surface!
- Check the clutch disk (10) for lateral runout before installation (max. 0.5 mm)
- Check the transmission input shaft (11) for damage and axial clearance, grease the hub profile or shaft. Remove surplus grease
- Note the installation position of the clutch disk/hub (12)! Use a centering pin to assist the installation process
- Check the guiding sleeve of the release bearing (13) for wear and replace the guiding sleeve if necessary; use a suitable lubricant
- Tighten the bolts in the clutch pressure plate (14) alternately to the specified torque.
  Always remove and install the SAC using a suitable special tool, e.g. the Schaeffler Automotive Aftermarket tool (part no. 400 0237 10)
- Ensure that the clutch pressure plate (15) is centered on the flywheel! During the external centering process, note the condition of the fitting edges on the clutch pressure plate and the flywheel
- Note that if the disk spring fingers (16) or release levers are in a tilted position because of the thickness tolerances of the friction lining, the position of these components will adjust independently after a short period of operation. **Important:** Readjusting a fixed setting performed by LuK at the factory voids the warranty!
- Check the clutch control (17) for correct operation and wear! Replace the clutch cable and check the bearing arrangements
- Ventilate the hydraulic system (18), checking for leaks. Note the release travel of the piston rod for the slave cylinder. The initial position must be reached when idling
- Replace the hydraulic CSC whenever the clutch is replaced
- Check that the engine is centered in relation to the transmission (19). Replace dislodged fitting sleeves
- Set the release bearing play (20) to 2–3 mm. Note that the moving bearings are operated at a preload of 80–100 N. Combine bearings that have plastic sleeves only with metal guiding sleeves

Lubrication
When it comes to the clutch and release system, the message "less is more" always applies. Thanks to modern materials, additional lubricants are generally no longer essential. However, there are still some older systems on the market that must be provided with lubricant at precisely defined points. The choice of medium depends on the information provided by the vehicle manufacturer. In the absence of any specification, a temperature-resistant and age-resistant high-performance grease with MoS_2 (e.g. Castrol Olista Longtime 2 or 3) can be used. Professional greasing of the transmission input shaft and the hub of the clutch disk is recommended as follows:

- Apply grease to the hub of the clutch disk and the gearing of the transmission input shaft
- Guide the clutch disk onto the transmission input shaft in three different angular positions, and then remove the clutch disk
- Remove excess lubricant from the hub and shaft

> **Note:**
> Chemically nickel-plated hubs (recognizable from the slightly silvery sheen of the surface) must not be greased!

Rigid flywheel
When replacing the clutch, it is advisable to check the friction surface of the flywheel for wear marks, such as scoring, hot spots or discoloration. It is crucial that these marks are removed, since they impair the function of the new clutch. The rework, i.e. the grinding/truing, must remain within the tolerances specified by the vehicle manufacturer. It is important to ensure that the mounting surface of the clutch is reworked to the same extent as the contact surface. At the same time, the ring gear must also be visually inspected. The mounting screws must be replaced each time they are loosened.

Dual mass flywheel (DMF)
- DMFs that have fallen must not be remounted, since the bearing track will have been damaged as a result of the drop
- The friction surface of the DMF must be degreased before the clutch pressure plate is installed. A cloth moistened with degreasing agent is required for this purpose. Direct contact with cleaning agents (parts washer, high-pressure cleaner, compressed air and cleaning spray) is not permitted
- Note the distance between rotational speed sensor and the DMF transmitter pins
- The sensor ring for detecting the engine speed must be checked for damage
- Reworking the DMF friction surfaces is not permitted
- Using mounting screws that are too long for the clutch pressure plate will block the DMF. This will cause noise or damage to the powertrain components. It is also important to ensure that the dowel pins are not pushed in, since this will also lead to the complaints mentioned above
- If the DMF has plain bearings, the secondary flywheel must not be moved in an axial direction using excessive force, i.e. not using a lever or screwdriver
- It is crucial that new mounting screws are used during installation, since these are expansion screws

Pilot bearing
Unobtrusive and small, but has a big impact in the event of a malfunction: The pilot bearing, also known as the guide bearing, guides the transmission input shaft and is therefore essential for the clutch functionality. The pilot bearing must be inspected, and if necessary replaced, whenever the clutch is replaced.

Rotary shaft seals
Even slight traces of oil and grease significantly impair the function of the clutch. Traces on the clutch bell or on the clutch indicate leaks. With older, high-mileage vehicles, the rotary shaft seals around the clutch generally need to be replaced.

Clutch disk
Lightweight construction in cars also applies to the clutch disk. Weight-optimized disks react to rough treatment with lateral runout. It is therefore advisable to check lateral runout prior to installation if the packaging is missing or damaged. The maximum permissible lateral runout is 0.5 mm.

Centering
The centering of the clutch disk is key to the correct installation of the transmission and to the clutch functionality. Centering ensures that the transmission input shaft can be smoothly guided through the hub profile of the clutch disk during installation. This prevents the risk of damage to the clutch disk or to the hub profile. To permit centering on as many vehicle types as possible, Schaeffler Automotive Aftermarket has developed a universal centering pin. This is a component of the special tools set with the part number 400 0237 10.

Fitting sleeves
When the engine and transmission are joined together, component tolerances can converge and, in unfavorable combinations, cause radial offset. When this occurs, the rotational axes of the crankshaft and transmission input shaft are not on the same plane. This inevitably leads to noise and increased clutch wear. Fitting sleeves are used to guarantee the optimum position of the transmission during installation and thereby minimize offset. It is therefore essential to ensure that no fitting sleeves are damaged prior to installing the transmission.

Special tools set (part no. 400 0237 10)
for assembling the clutch

Work on the release system
Sensors
Master and slave cylinders are increasingly equipped with sensors to measure the actuation travel and to forward this information to the engine and transmission control unit. As a rule, systems equipped with sensors can be recognized by the fact that a small housing with a plug or cable connection is attached to the master or slave cylinder. Each sensor is coordinated individually with the master or slave cylinder and therefore forms a unit with the respective component. Sensors must not be removed from one cylinder and attached to another one. If one of these components is defective, a new cylinder/sensor combination must always be installed.

Hydraulic fluid
Fully hydraulically actuated clutches can be equipped with closed or externally supplied release systems. In the case of a closed system, there is no connection to vehicle-side liquids. The system is maintenance-free. Therefore there is no option of changing or topping up the hydraulic fluid. The externally supplied system is connected to the brake fluid reservoir via a hose. The brake fluid absorbs water as a result of being used in the vehicle. This can result in damage to the seals or to the development of noise at the master cylinder. To prevent this, it is necessary to replace the brake fluid at least every two to three years. When choosing the replacement fluid, it is strongly recommended that the recommendations of the respective vehicle manufacturer be followed. The maintenance of a hydraulic release system is normally limited to the replacement of the brake fluid. Similarly to the brake, the fluid is refilled by pumping on the pedal and at the same time opening and closing the vent screw. To ensure that the rinsing process is carried out as completely as possible and no air bubbles can enter the system, the specific recommendations of the vehicle manufacturer must also be considered in such cases. Cleanliness is imperative during all work on the hydraulic system. Even the smallest contaminations due to dirt particles can result in leaks and malfunctions. For systems that are designed for brake fluid, mineral oil may under no circumstances enter the interior. For this reason, the cylinders or the connectors must not be relubricated. Even the smallest amounts of mineral oil can result in the destruction of the seals. For clutch systems that have a common reservoir with the brake, there is a definite risk of contamination right into the brake system.

Release shaft
The release shaft must always be removed to assess damage because a test in the installed state is impossible. A run-in or worn bearing arrangement leads to tilting of the release shaft and therefore to stiffness and/or grabbing. The bearing arrangement must always be lubricated.

Release lever/bearing arrangement
Professional corrective maintenance of a clutch includes an inspection of the clutch release lever and its bearing arrangement. During this inspection, the supporting surfaces of the lever and the counter bearing in the transmission must be examined carefully for signs of wear. If pronounced wear is detected, the components must be replaced.

Guiding sleeve
The guiding sleeve must be positioned absolutely centrally and exactly parallel to the main transmission shaft. Pressure or wear points on the sleeve can interfere with the sliding movement of the release bearing and result in grabbing or slipping of the clutch. Damaged or worn guiding sleeves must always be replaced, since this represents one of the main reasons for stiff clutch control.

Release bearing
A functional test of the release bearing is not possible in the garage. Even a worn thrust ring inevitably leads to noise. For this reason, a replacement is generally necessary when the clutch is replaced. After installation, the release bearing must slide easily on the guiding sleeve.

Concentric slave cylinder (CSC)
To prevent damage to the CSC, the following procedure is recommended during installation:
- Install the CSC and tighten the screws manually as far as they will go
- Mount the hydraulic line adapter (if present)
- Tighten the screws to 2 Nm
- Tighten the screws in accordance with the instructions from the vehicle manufacturer

Clutch cable
Since a precise functional test of the cable is not possible in the garage, it is recommended that the cable be replaced with every clutch replacement. Note the correct assembly procedure. A cable that is too severely bent or kinked adversely affects operating comfort.

Lubricant
Thanks to modern materials, the current release system largely does not need lubricant. When it is actually required, lubricant is used only at precisely defined points in accordance with to the vehicle manufacturer's specifications. Master and slave cylinders, as well as the CSC, may not come into contact with lubricants.

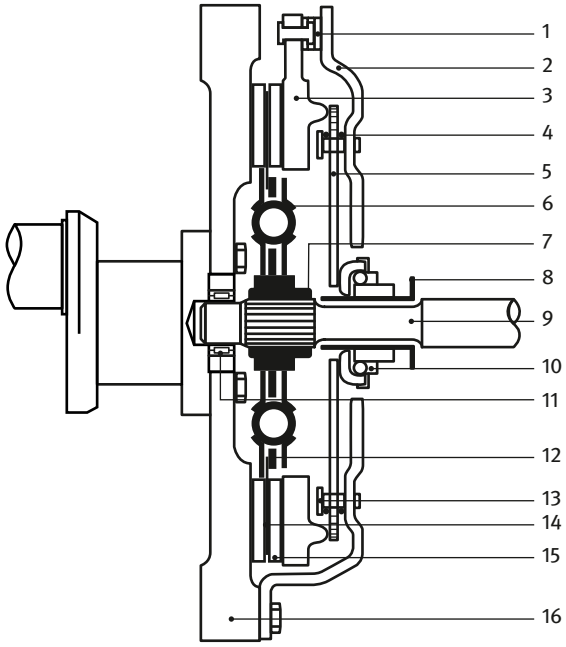
The LuK RepSet DMF: The complete solution for professional clutch repairs

3 The Clutch – Design and Function

In the clutch cover, the disk springs, spacer bolts, support rings, tangential leaf springs and the pressure plate form a mechanism that permits a friction lock-up connection that can be modulated. The disk spring generates the clamp load and forms the lever between the release bearing and pressure plate. Support rings guided via spacer bolts act as the support point for the disk spring. The pressure plate is centrally guided by several tangential leaf springs in the clutch cover. Power is transmitted by the clutch disk with the clutch linings. The clutch disk creates a friction lock-up connection with the engine via the linings, and a form-fit connection with the transmission input shaft through the hub.

1 Tangential leaf spring
2 Clutch housing/clutch cover
3 Pressure plate
4 Support ring (also pivot ring)
5 Disk spring
6 Torsional damper
7 Hub
8 Guiding sleeve
9 Transmission input shaft
10 Release bearing
11 Pilot bearing (also guide bearing)
12 Clutch disk
13 Spacer bolts
14 Segments for cushion deflection
15 Friction lining
16 Flywheel

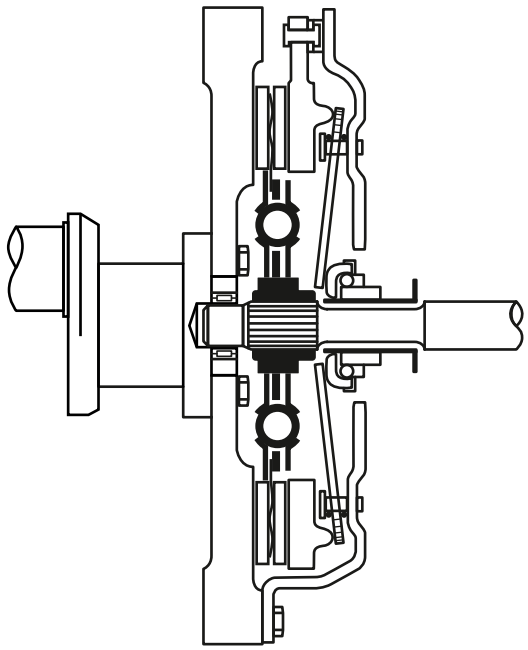
Dry single-disk clutch (closed), components



Clutch closed
In the engaged state, the force of the disk spring acts on the pressure plate. This pushes the axially movable clutch disk against the flywheel. A friction lock-up connection is created. This allows the engine torque to be directed via the flywheel and the pressure plate to the transmission input shaft.

Clutch open
When the clutch pedal is actuated, the release bearing is moved against the disk spring load in the direction of the engine. At the same time, the disk springs are deflected over the support rings, and the force on the pressure plate is reduced. This force is now so low that the tangential leaf springs are able to move the pressure plate against the disk spring load. This creates play between the friction surfaces, allowing the clutch disk to move freely between the flywheel and the pressure plate. As a result, the power flow between the engine and transmission is interrupted.

Dry single-disk clutch (open)



4 The Hydraulic Release System – Design and Function

For vehicles with manually operated dry clutches, the pedal force applied by the driver needs to be amplified using a mechanism and transmitted to the clutch. Vehicle developers have come up with various solutions to perform this function. Originally, the pedal force was transmitted via a cable from the pedal to a lever mechanism in the clutch bell. The clutch was operated via the lever and a clutch release bearing. The market share of these systems is now negligible. This is because the increasingly narrow engine compartments make it increasingly difficult to route a cable between the pedal and the lever in as straight a line as possible. Narrow radii in a cable are not feasible because the friction and wear increase to an impermissible level and comfort during clutch control is adversely affected.

Hydraulic clutch control is used in modern foot-actuated clutches. A distinction is made between two systems:

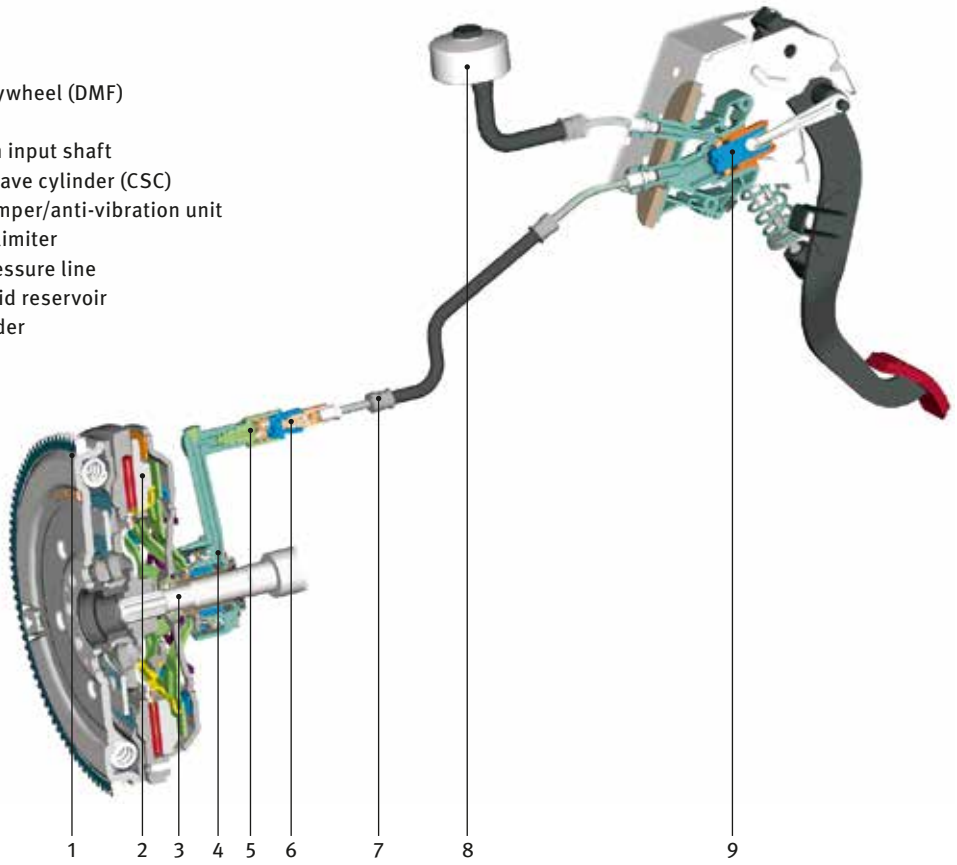
- Semi-hydraulic
- Fully hydraulic

In the semi hydraulic systems, the cable is replaced by a hydraulic line consisting of a master cylinder on the pedal, a pipe and a slave cylinder on the outside of the transmission.

In a fully hydraulic system, the functions of the transmission-side release mechanism are taken over by a CSC, which is directly located in the bell housing between the transmission and the clutch.

Design of a fully hydraulic clutch system

1 Dual mass flywheel (DMF)
2 Clutch
3 Transmission input shaft
4 Concentric slave cylinder (CSC)
5 Vibration damper/anti-vibration unit
6 Peak torque limiter
7 Hydraulic pressure line
8 Hydraulic fluid reservoir
9 Master cylinder



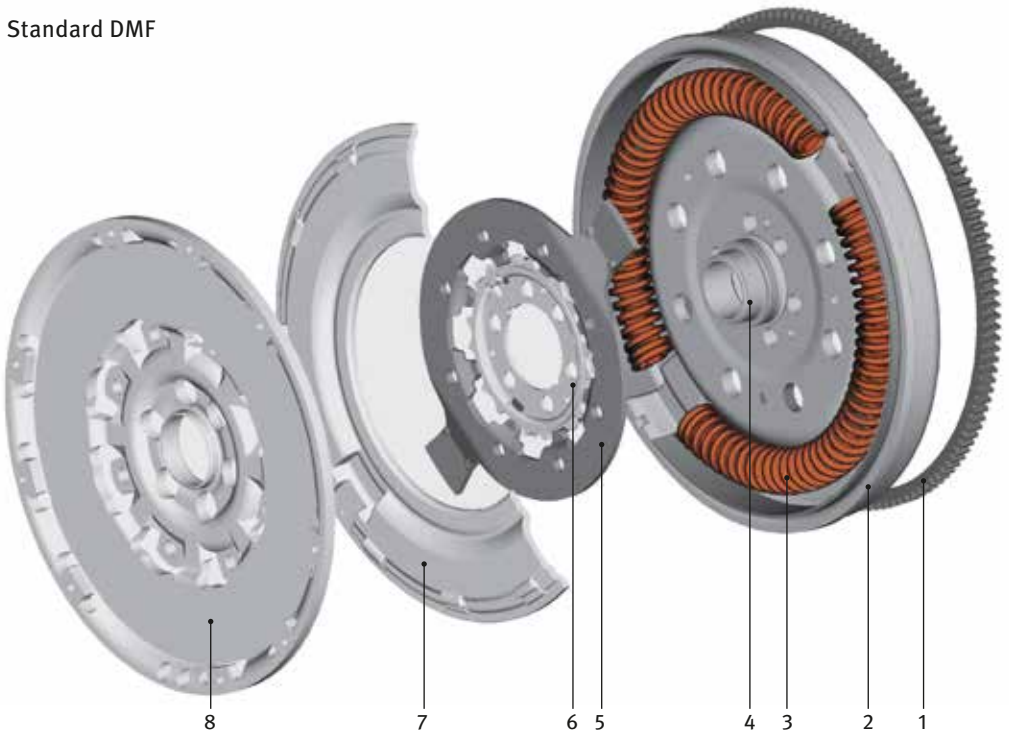
Note:
Further information about the release system and the clutch can be found in the "LuK Clutch Course" brochure.

5 The Dual Mass Flywheel (DMF) – Design and Function

A standard DMF consists of the primary flywheel and the secondary flywheel. The two decoupled flywheel masses are connected to each other via a spring/damping system and are positioned opposite each other via a deep groove ball bearing or a plain bearing so they can be turned. The primary flywheel with the ring gear assigned to the engine is screwed tight to the crankshaft. Together with the primary cover, it encloses a cavity that forms the spring channel. The spring/damping system consists of arc springs. They lie in guide shells in the spring channel and fulfill the requirements for an "ideal" torsional damper at an extremely low cost.

The guide shells enable smooth travel while grease filling in the spring channel reduces the friction between the arc springs and guide shell. The engine torque is transferred via the flange. The flange is riveted together with the secondary flywheel and grips between the arc springs with the tabs of the flange. The secondary flywheel increases the mass moment of inertia on the transmission side. For better heat dissipation, the secondary flywheel is provided with air flow openings. Since the spring/damping system is located in the DMF, a rigid design without a torsional damper is generally used as a clutch disk.

Standard DMF



1 Ring gear
2 Primary flywheel
3 Arc spring
4 Plain bearing
5 Flange
6 Floating pivoted reaming holder
7 Primary cover (cross section)
8 Secondary flywheel

The advantages of the DMF at a glance:

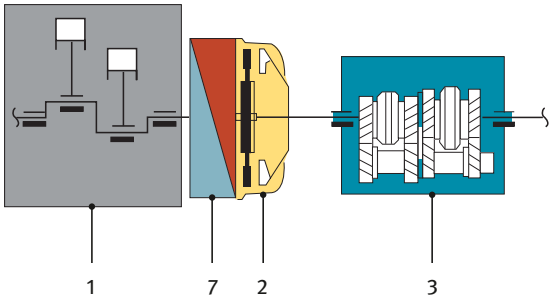
- First-class driver comfort
- Absorbs vibrations
- Insulates against noise
- Fuel saving thanks to low engine speeds
- Increased shifting comfort
- Lower synchronization wear
- Overload protection for the powertrain

The basic principle of the DMF is simple and efficient. With the secondary spring mass system on the transmission input shaft, the resonance point, which lies between 1200 and 2400 rpm in the original torsional dampers, is shifted to lower speeds. As a result, outstanding vibration isolation is already present from idle speed.

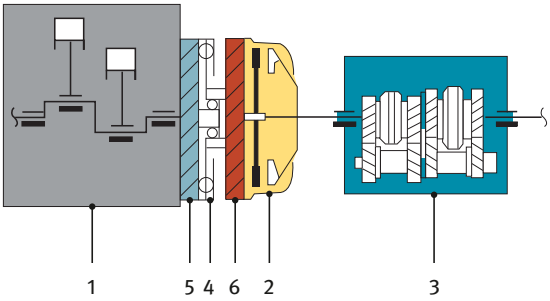
For the previous standard design with a conventional flywheel and torsionally damped clutch disk, the torsional vibrations in the idle range are passed on to the transmission largely unfiltered and cause the tooth flanks of the gear wheels to knock against each other (gear rattle).

By contrast, as a result of using a DMF, the torsional vibrations introduced by the engine are filtered out by the spring/damping system, and the transmission components are not subjected to them – there is no rattling and expectations regarding to comfort are fully met.

Functionality with a conventional flywheel



Functionality with a DMF



1 Engine
2 Clutch
3 Transmission
4 Torsional damper
5 Primary flywheel
6 Secondary flywheel
7 Flywheel

It is advisable to inspect the DMF each time that the clutch is replaced. Using the LuK DMF inspection tool (part no. 400 0080 10), the most important measurements, namely the clearance angle and the tilting clearance, can be performed at the garage. The clearance angle is the angle at which the primary and secondary masses of the DMF can be twisted against each other before the spring force of the arc springs takes effect. The tilting clearance occurs when the two twist-mounted DMF masses are tilted towards one another or away from one another. The nominal values are specified in the parts catalog under the corresponding part number.

Note:
Further information about the release system and the clutch can be found in the "LuK DMF" brochure.

The LuK RepSet DMF inspection tool, part no. 400 0080 10

Optionale Absender-Details (hervorgehoben)
Optionale Absender-Details (zweite Zeile)
Optionale Absender-Details (dritte Zeile)
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